

WHAT IS CLAIMED:

1. A method for constructing a part of a tooth using a hardened object, said method comprising:

(i) forming a hardenable object into a shape suited for reconstructing part of a tooth from a microwave curable composition comprising:

(a) multi-functional polymers and monomers at least one member selected from the group consisting of mono-functional methacrylate polymer, di-functional methacrylate polymer, tri-functional methacrylate polymer, mono-functional methacrylate monomer, di-functional methacrylate monomer, and tri-functional methacrylate monomer; filler; coupling agent; initiator; plasticizer; and optionally additional additives for pigmenting; or

(b) a polymer matrix including a polymerizable resin adapted for use in an oral environment which contains at least one ester of unsaturated compounds; coupling agent; filler; initiator; and; optionally, additional additives for pigmenting; and

(ii) using a hand held microwave source to apply microwave energy to harden said hardenable object.

2. A method according to claim 1, wherein said composition is (a).

3. A method according to claim 1, wherein said filler comprises inorganic filler or organic

filler.

4. A method according to claim 1, wherein (b) comprises a polymer matrix including a polymerizable resin adapted for use in an oral environment; filler; initiator; coupling agent; and, optionally, additional additives for pigmenting.

5. A method according to claim 4, wherein the polymerizable resin comprises at least one of 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy) phenyl] propane, triethyleneglycol dimethacrylate, or an urethane dimethacrylate resin.

6. A method according to claim 1, wherein said composition comprises (b).

7. A method according to claim 6, wherein said initiator comprises at least one microwave sensitive compound.

8. A method according to claim 7, wherein said initiator is a peroxide.

9. A method according to claim 8, wherein the initiator is selected from the group comprising benzoyl peroxide and dilauroyl peroxide.

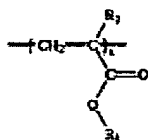
10. A method according to claim 7, wherein said composition contains up to 2.5% by weight of said initiator.

11. A method according to claim 1, wherein (a) further comprises an amine accelerator.
12. A method for forming a hardened relined material for a dental prosthesis comprising:
 - (i) forming a hardenable object configured for relining a dental prosthesis from a microwave curable composition comprising a polymer matrix including a polymerizable resin adapted for use in an oral environment; filler; initiator; coupling agent; and optionally, additional additives for pigmentation; and
 - (ii) using a hand held microwave source to apply microwave energy to harden said hardenable object.
13. A method according to claim 12, wherein the polymerizable resin contains at least one of 2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy) phenyl] propane, triethyleneglycol dimethacrylate, or an urethane dimethacrylate resin.
14. The method of claim 12, wherein said filler comprises inorganic filler or organic filler.
15. The method and materials to make polymer-based objects, including:
 - (a) the process, which is the combination of injection, measurable pressure and microwave energy;
 - (b) the composition used in this process and systems.
16. The use of said process and system of claim 15, to give high accuracy shape and hardening of polymers and polymer-containing composites.

17. The use of a hand-held microwave applicator to harden polymers and polymer containing composites at the site of application (i.e., intra-oral, orthopedic).

18. The composition of claim 15, wherein said polymer-based materials, which are suitable for denture base, include one and two component denture bases, said denture base comprising of mono-, di-, tri-, or multifunctional methacrylate polymers or monomers; cross-linking agent; organic pigments or metal oxides; plasticizers and initiators.

19. The composition of claim 18, wherein said mono-, di-, tri-, or multifunctional methacrylate polymers are within the scope of the general formula:



The R_1 is hydrogen, alkyl, substituted alkyl group, cyclic hydrocarbon, benzyl, ether, hydroxalkyl; R_2 is hydrogen, halogen, alkyl, substituted alkyl group; and n is an integer at least equal to 2.

20. The composition of claim 15, wherein said polymer-based objects are made from polymer based material that is suitable for use as composite resins, said polymer based material further comprised of a polymer matrix; fillers; initiator; and coupling agent.

21. The composition in claim 20, wherein said polymer matrix is a polymerizable resin

suitable for use in an oral environment.

22. The composition of claim 21, wherein the polymerizable resin includes 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy)phenyl] propane, triethyleneglycol dimethacrylate, urethane dimethacrylate resins, and spiro orthocarbonates.

23. The composition of claim 20, wherein said initiator comprises microwave sensitive compounds.

24. The composition of claim 23, wherein said initiator comprises a peroxide.

25. The composition of claim 24, wherein said initiator is selected from the group comprised of benzoyl peroxide and dilauroyl peroxide.

26. The composition of claim 20, wherein the initiator comprises up to 2.5% by weight of the composition.

27. The composition of claim 15, wherein said polymer-based materials, which are suitable for soft dentures, consist of organopolysiloxanes or phosphonitrile fluoroelastomers.

28. The composition of claim 27, wherein said organopolysiloxanes are within the scope of the general formula:

$[R_nSiO_{4-n/2}]_m$, wherein $n=1-3$ and $m>1$. R is methyl, longer alkyl, fluoroalkyl, phenyl, vinyl, alkoxy or alkylamino.

29. The composition of claim 27, wherein said phosphonitrilic fluoroelastomers are within the scope of the general formula:



wherein X is H or F, and n is usually form 1 to 11.

30. A method for forming a hardened reline material for a dental prosthesis comprising:

(i) forming a hardenable object configured for relining a dental prosthesis from a microwave curable composition comprising a polymer matrix including a polymerizable resin adapted for use in an oral environment; filler; initiator; coupling agent; and optionally, additional additives for pigmenting; and

(ii) using a hand held microwave source to apply microwave energy to harden said hardenable object.

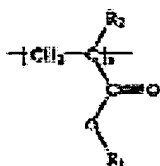
31. A method according to claim 30, wherein the polymerizable resin contains at least one of 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy) phenyl] propane, triethyleneglycol dimethacrylate, or an urethane dimethacrylate resin.

32. The method of claim 30, wherein said filler comprises inorganic filler or organic filler.

33. A method for forming a hardened object comprising:

(i) forming a hardenable object from a microwave curable composition comprising:

(a) at least one polymer including repeating monomer units represented by the formula



wherein

R₁ represents a hydrogen atom, an alkyl group, a substituted alkyl group, a benzyl group, a hydroxy alkyl group, a cyclic hydrocarbon, or an ether group,

R₂ represents a hydrogen atom, a halogen atom, an alkyl group, or a substituted alkyl group, and

n is an integer of 2 or more;

a curing agent; a filler; an initiator; a plasticizer; and, optionally, additional additives for pigmenting;

(b) at least one member selected from the group consisting of an organopolysiloxane and a phosphonitrile fluoroelastomer; filler; crosslinking agent; and, optionally, additional additives for pigmenting; or

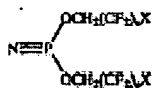
(c) a polymer matrix including a polymerizable resin adapted for use in an oral environment; filler; initiator; coupling agent and, optionally, additional additives for pigmenting; and

(ii) using a hand-held microwave source to apply microwave energy to harden

said hardenable object.

34. A method according to claim 33, wherein the polymerizable resin contains at least one of 2,2-bis[4-(2-hydroxy-3-methacryloxypropoxy) phenyl] propane, triethyleneglycol dimethacrylate, or an urethane dimethacrylate resin.

35. A method according to claim 33, wherein said at least one phosphonitrile fluoropolymer is obtained by polymerizing monomers comprising:



wherein X represents a hydrogen atom or fluorine atom, n is a value of 1 to 11.

36. A method according to claim 33, wherein said organopolysiloxane is represented by the formula $[\text{R}_n\text{SiO}_{4-n/2}]_m$, wherein $n=1-3$ and $m>1$. R is methyl, longer alkyl, fluoroalkyl, phenyl, vinyl, alkoxy or alkylamino.

37. A method for forming a hardened object comprising:

(i) forming a hardenable object from a microwave curable composition, said object when cured comprising a dental prosthesis or an orthodontic element, said microwave curable composition comprising:

(a) at least one member selected from the group consisting of mono-functional methacrylate polymer, di-functional methacrylate polymer, tri-

functional methacrylate polymer, mono-functional methacrylate monomer, di-functional methacrylate monomer, and tri-functional methacrylate monomer; curing agent, filler, initiator; plasticizer; and optionally, additional additives for pigmenting;

(b) at least one member selected from the group consisting of an organopolysiloxane and a phosphonitrile fluoroelastomer; filler; crosslinking agent; and optionally, additional additives for pigmenting; or

(c) a polymer matrix including a polymerizable resin adapted for use in an oral environment; filler; initiator; coupling agent; and; optionally, additional additives for pigmenting; and

(ii) using a hand-held microwave source to apply microwave energy to harden said hardenable object.

38. A method according to claim 37, wherein the polymerizable resin comprises at least one of 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy) phenyl] propane, triethyleneglycol dimethacrylate or an urethane dimethacrylate resin.

39. A method according to claim 37, wherein said hardened object comprises a dental prosthesis.

40. A method according to claim 39, wherein said dental prosthesis comprises a composite resin filling, inlay, overlay, facing, veneer or orthodontic appliance.

41. A method according to claim 37, wherein said filler comprises organic filler or inorganic filler.